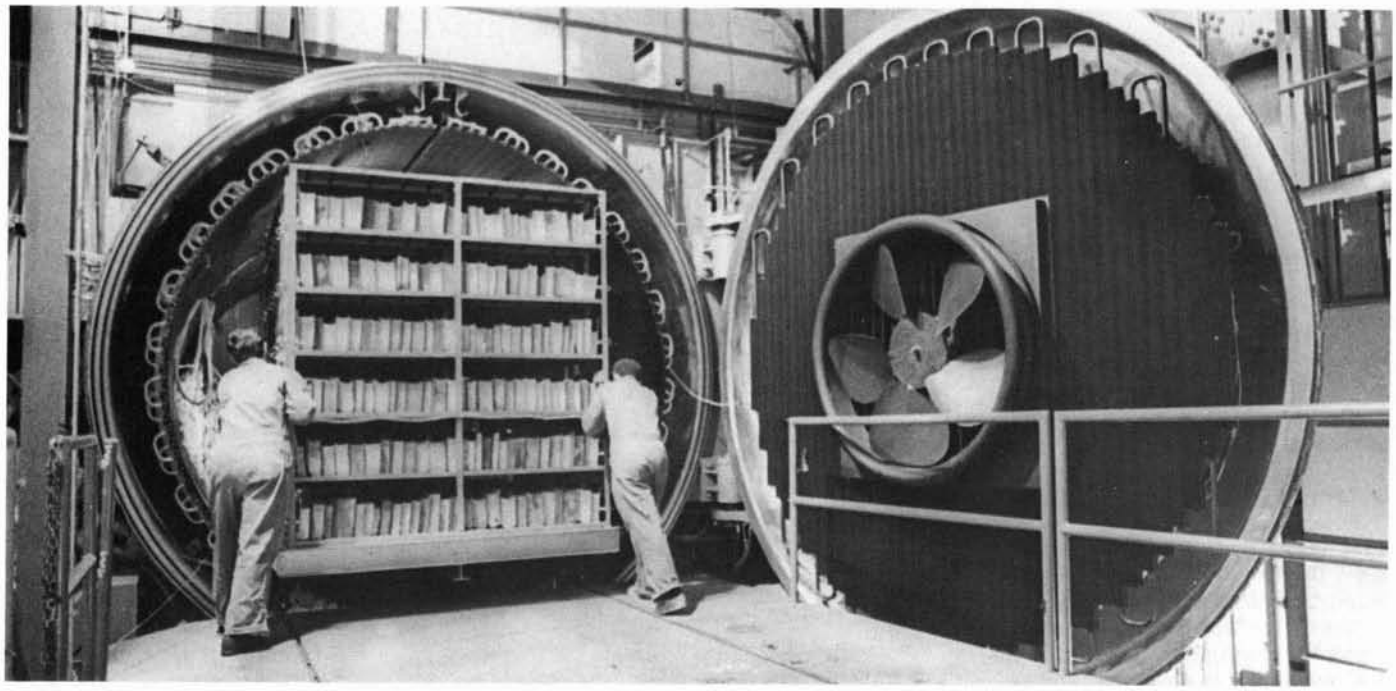

Vacuum Drying Technique

At Valley Forge, Pennsylvania, General Electric Company's Space Division has a large environmental chamber for simulating the conditions under which an orbiting spacecraft operates. Normally it is used to test company-built space systems, such as NASA's Landsat and Nimbus satellites. It is also being used in a novel spinoff application—restoring water-damaged books and other paper products and textiles.

This unique technology transfer began in 1972 when Temple University's Klein Law Library caught fire. In the course of extinguishing the fire, almost 60,000 books, some irreplaceable, were completely soaked by tons of water from high-pressure fire hoses. Looking for a means of salvage, Temple's insurance company contacted GE's Space Division, whose officials felt that the space vacuum chamber could be effectively employed as a dryout tank. Temple's books were loaded onto wheeled racks and placed in the chamber 4,000 at a time; the upper photo shows one rack of 750 Temple volumes being wheeled into the 3,000-cubic-foot chamber. The technique worked and Klein Law Library's books are back on their shelves. GE is now providing the service regularly, treating items damaged by storms, floods, fire-fighting activities, waterline ruptures or other environmental conditions. An example of a badly water logged book restored to excellent condition is the rare 17th century volume shown in the photo at right.

When the books are in place and the vault-like door secured, chamber pressure is reduced to spacelike conditions of 1/100th of an atmosphere, promoting evaporation of water. As the water evaporates, it freezes in the near-vacuum. After 24 hours, pressure is increased to break the vacuum. Then hot freon gas is introduced to the chamber, causing the ice to melt; the water is drained off through an opening in the chamber. This process is repeated until the damaged materials are thoroughly dry.

The process represents a major improvement over an existing method, which involves blotting individual pages by hand and air-drying them slowly at a cost of about $100 a volume. The space simulator process costs only $2 per book. GE has used it to dry many loads of books, blueprints, important government records, historical documents, a stamp collection and several thousand pairs of shoes. Among the numerous customers who have benefited from the technique are the University of Pittsburgh, Otis Elevator, Corning Glass, the Paul Mellon estate, Hillside Jewish Memorial Hospital and a number of state, city and county governments.